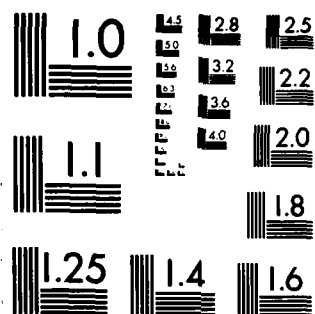


NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
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MASSACHUSETTS COASTAL BASIN
GLOUCESTER, MASSACHUSETTS

WEST POND OUTLET
MA 00186

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

FEB 13 1980

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the West Pond Outlet Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Mr. Richard Russo of Beverly, Massachusetts.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely,


MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

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As stated

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WEST POND OUTLET

MA 00186

MASSACHUSETTS COASTAL BASIN
GLOUCESTER, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA 00186

Name of Dam: West Pond Outlet

City: Gloucester

County and State: Essex County, Massachusetts

Stream: Massachusetts Coastal Basin

Date of Inspection: September 27, 1979

The impounding structure at West Pond is a 123-foot long, 12-foot high earthfill dam with an overflow spillway at the east abutment. Available data indicates that the dam was originally built before 1885. It is reported that the dam is constructed of earthfill between two stone masonry walls. The upstream wall functions as the core wall for the dam. The downstream wall is covered by earth fill, although erosion has exposed parts of the wall. The top of the dam varies from elevation (El) 72.8 to 74.8. The spillway is located at the east abutment of the dam and consists of a notched ungated concrete weir with an overall length of 16 feet. The notched portion of the spillway is 4.0 feet long and is at El 72.6. The low point on the top of the dam is lower than the unnotched portion of the spillway. Discharge from the spillway flows over a bedrock outcrop for 25 feet and then flows into the unlined stream channel below the dam.

Based on the visual inspection of the site and a review of the limited data available on the dam, the dam is considered to be in poor condition and is in need of extensive repair work. Also, additional engineering investigations are required to evaluate the condition of the dam and to determine procedures required to assure its continued performance.

WEST POND OUTLET

>The following deficiencies were observed at the site: moderate seepage below the toe of the dam; severe erosion of the upstream slope exposing the core wall; erosion of the top and downstream slope of the dam, localized bulging along the downstream slope; lack of a low level outlet; separation of the training walls from the spillway; seepage around and beneath the spillway; brush, timber, and debris in the discharge channel; and trees and vegetation growing on the slopes of the dam.

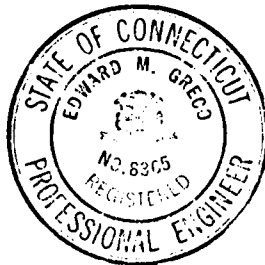
Based on the Corps of Engineers guidelines, the dam has been classified in the "small" size and "significant" hazard categories. The drainage area of West Pond is 0.24 square miles. A test flood equal to the 100-year storm, (approximately one-quarter the probable maximum flood (PMF)), was used to evaluate the capacity of the spillway. Hydraulic analyses indicate that the spillway can discharge a maximum flow of 1.2 cfs (cubic feet per second) when the water surface is at El 72.8, which is the low point on the top of the dam. The peak test flood outflow of 107 cfs will result in the pond at El 74.1 and will overtop the dam by a maximum of 1.3 feet. The spillway can discharge only 1.1 percent of the test flood before the dam is overtopped.

It is recommended that the Owner employ a qualified engineering consultant to conduct a more detailed hydraulic and hydrologic study to evaluate spillway capacity and overtopping potential. The consultant should also conduct a complete geotechnical and structural investigation of the structure, including an evaluation of the seepage at the toe of the dam. This investigation should also include an evaluation of the seismic stability of the dam. It is recommended that the Owner immediately drain the pond and breach the dam until the recommendations by the engineering consultant are implemented.

The Owner should implement a program of annual technical inspections and monthly maintenance inspections of the dam and appurtenances. It is also recommended that the Owner implement a plan for surveillance of the embankment during and after periods of high runoff and a plan for warning downstream residents in the event of an emergency at the site.

WEST POND OUTLET

The measures outlined above and in Section 7 should be implemented by the Owner within a period of one year after receipt of this Phase I Inspection Report.



Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 29800 Approved by:

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703



WEST POND OUTLET

This Phase I Inspection Report on West Pond Outlet has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Aramant Mahtesian

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported conditions of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

WEST POND OUTLET

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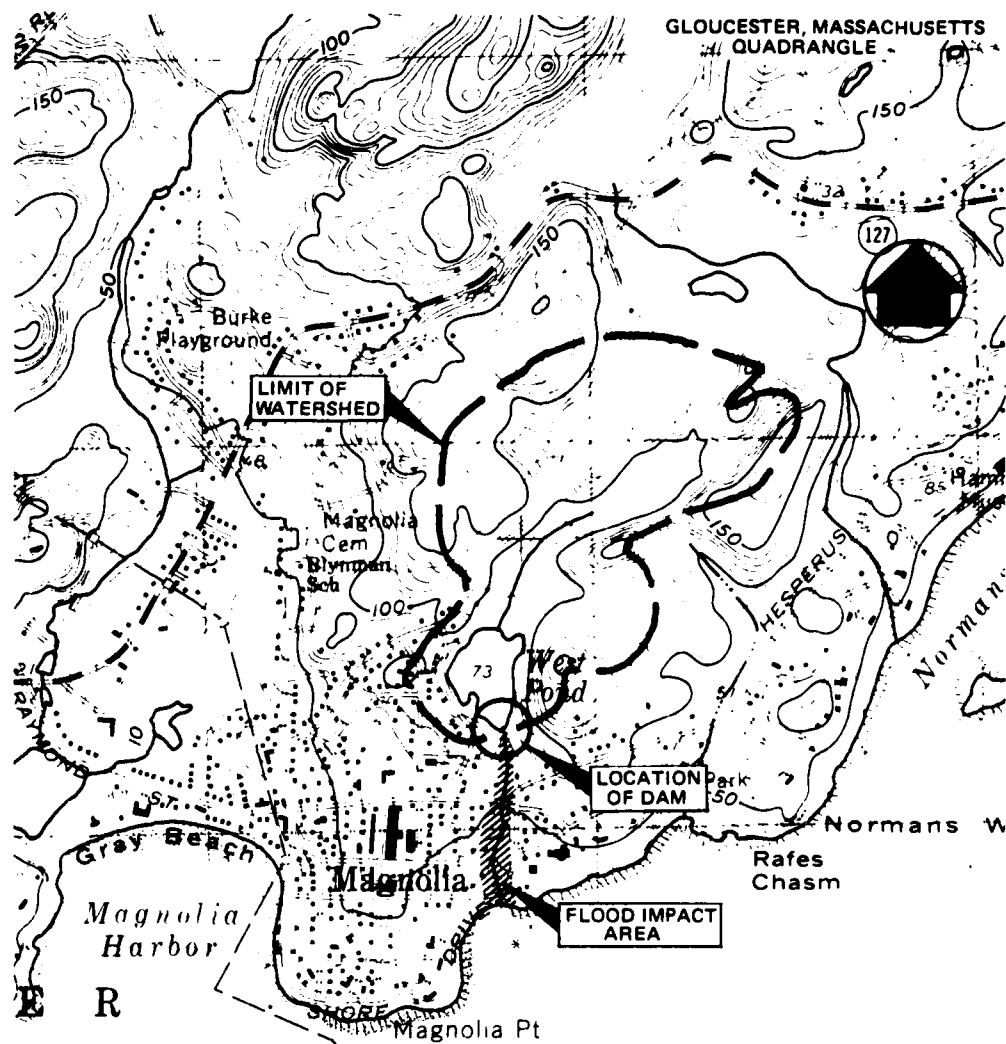
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OVERVIEW
WEST POND DAM
GLOUCESTER, MASSACHUSETTS





M A S S A C H U S E T



LOCATION MAP - WEST POND

NATIONAL DAM INSPECTION
PROGRAM
PHASE I INSPECTION REPORT
WEST POND
SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0054, dated March 27, 1979, has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to quickly initiate effective dam safety programs for non-Federal dams.
- (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The dam is located on an unnamed brook that discharges directly to the Atlantic

WEST POND OUTLET

Ocean. The dam lies within the corporate boundary of the City of Gloucester, which is in Essex County, Massachusetts. The coordinates of the dam are latitude 42 deg. 34.7 min. north and longitude 70 deg. 42.5 min. west.

- b. Description of Dam and Appurtenances. West Pond Outlet is a 123-foot long earthfill dam with a maximum height of 12 feet (see Figures B-1 and B-2 and photographs 1 and 2 in Appendix C). The dam is reported to have been built prior to 1885 and the impoundment was used for the production of ice. The top of the dam is 2.5 feet wide and varies from El 72.8 to El 74.8. The upstream slope is nearly vertical covered with loose stone. The downstream slope is an irregular earth slope at approximately 1-1/2:1 (horizontal to vertical). The slopes and top of the dam are covered with trees and brush.

The spillway is located at the east abutment and consists of a notched 16-foot long ungated weir. The notch is centrally located in the spillway and is 0.3 feet deep and 4.0 feet long. The notch is at El 72.6 and the crest of the main spillway is at El 72.9. The sidewalls are made of concrete and stand 5.2 feet above the base of the spillway. The spillway discharges onto a rock outcrop from where it is directed by a training wall downstream into the stream channel.

- c. Size Classification. West Pond Outlet is classified in the "small" category, since it has a maximum height of 12 feet and a maximum storage capacity of 52acre-feet.
- d. Hazard Classification. Four houses are located between West Pond Outlet and the Atlantic Ocean. Failure of the dam would produce a flood wave 9 feet deep as compared to a water depth of less than 1 foot prior to failure. This flood wave could cause appreciable property damage and the loss of a few lives in the downstream area. Therefore, the dam has been placed in the "significant" hazard category.

WEST POND OUTLET

- e. Ownership. Mr. Richard Russo of 100 Cabot Street, Beverly, Massachusetts 01915, has owned the dam since 1974. Mr. Russo (telephone 617-567-2586) gave permission to enter the property and inspect the dam.
- f. Operators. There is no equipment to operate at this dam and hence, there are no operators for the dam.
- g. Purpose of Dam. West Pond serves as a small recreation pond. In earlier years the pond was used to produce ice.
- h. Design and Construction History. The only records available on the design and construction of West Pond Outlet are the previous inspection reports from the Essex County Engineer's Office and the Massachusetts Division of Waterways (see pages B-3 through B-12). The dam is referred to in these reports as Stanwood Dam. The original date of construction of this dam is unknown. Early inspection reports state that "in 1886, a wall about 2 feet thick was built below the old dam and a space about 2 feet wide between the old and new walls filled with gravel." Plans and specifications for this work were approved by the County Commissioners in 1885 and the construction was supervised.

The dam has a history of being in poor condition. In the earliest inspection reports the dam is described as "fair" and it was recommended that the spillway capacity be increased as well as the top of the dam be raised. In more recent reports the dam condition has been described as "extremely dangerous" and substantial repairs have been recommended. Erosion of the slopes has been documented since 1936 and in 1958 this erosion exposed the upstream masonry core wall. Leakage below the toe of the dam has been noted in the inspection reports since 1928. Each inspection report describes the spillway as being obstructed with debris. A new concrete spillway was constructed in 1958.

WEST POND OUTLET

1. Normal Operating Procedures. There are no operating procedures at West Pond Outlet. Flow over the spillway is uncontrolled, and there is no low level outlet.

1.3 Pertinent Data

- a. Drainage Area. West Pond has a drainage area of approximately 0.24 square miles (155 acres). Except for the residential development bordering the western side of the pond, the land is largely undeveloped. An unnamed stream drains from the north into West Pond. The area is partly swampy and partly hilly with moderately steep slopes.
- b. Discharge. Normal discharge from West Pond flows over a 4-foot wide by 0.3 feet deep ungated notch that is centrally located in the spillway. The main spillway is 16 feet long with a 2.1-foot high sidewall on the west side and a natural rock outcrop on the east side. Discharge from the spillway drops onto a portion of the rock outcrop and is then directed by a concrete training wall into a stream channel. The channel leads to a 24-inch diameter concrete pipe beneath Hesperus Avenue located approximately 550 feet downstream, and then flows to a 36-inch steel pipe beneath Shore Drive another 800 feet further downstream before discharging into the Atlantic Ocean.

Hydraulic analyses indicate that the existing spillway can discharge 1.2 cfs with the water surface at 72.8, which is the low point on the dam. During the test flood (100-year storm), the peak discharge would be 107 cfs and would overtop the top of the dam by 1.3 feet. The spillway can discharge only 1.1 percent of the test flood before the dam is overtopped.

The only data available on past flood levels at the dam are visual observations recorded in the previous inspection reports (see pages B-3 through B-12).

WEST POND OUTLET

c. Elevation (feet above National Geodetic Vertical Datum (NGVD)).

A bench mark was established at El 73.0 at the high point of the spillway crest. This elevation was estimated from the U.S. Geological Survey topographic quadrangle.

- (1) Top of dam: 72.8 to 74.8
- (2) Test flood pool: 74.1
- (3) Design surcharge: Unknown
- (4) Full flood control pool: Not Applicable (N/A)
- (5) Recreation pool: 72.6
- (6) Spillway crest (ungated): 72.6
- (7) Upstream portal invert diversion tunnel: N/A
- (8) Streambed at centerline of dam: 62.0
- (9) Maximum tailwater: N/A

d. Reservoir

- (1) Length of maximum pool: 870 feet
- (2) Length of recreation pool: 870 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge (net): 12 at El 74.1
- (2) Top of dam: 52
- (3) Flood control pool: N/A
- (4) Recreation pool (El 72.6): 50
- (5) Spillway crest (El 72.6): 50

WEST POND OUTLET

f. Reservoir Surface (acres)

- (1) Top of dam: 8
- (2) Test flood pool: 8
- (3) Flood control pool: N/A
- (4) Recreation pool: 8
- (5) Spillway crest: 8

g. Dam

- (1) Type: earthfill
- (2) Length: 123 feet
- (3) Height: 12 feet
- (4) Top width: 2.5 feet
- (5) Side slopes: near vertical upstream and 1.5:1 downstream
- (6) Zoning: earthfill between masonry walls
- (7) Impervious core: mortared masonry wall
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

h. Spillway

- (1) Type: flat-crested weir
- (2) Length of weir: 16 feet
Length of notch: 4 feet
- (3) Crest elevation: 72.9
Crest of notch: 72.6
- (4) Gates: None
- (5) Upstream channel: no training walls;
bottom not visible

WEST POND OUTLET

(6) Downstream channel: concrete training wall on west side of channel; bedrock outcrop forms east side and bottom of channel.

1. Regulating Outlets. There is no regulating outlet at the dam.

WEST POND OUTLET

SECTION 2
ENGINEERING DATA

- 2.1 General. The only data available on the dam are reports and notes from past inspections obtained from the Essex County Engineer's Office and the Massachusetts Division of Waterways (copies in Appendix B). There are no known plans, specifications or computations available from the City, County or State offices relative to the design, construction, or repair of this dam.

We acknowledge the assistance and cooperation of personnel from the City of Gloucester, the Essex County Engineer's Office, and the Massachusetts Division of Waterways.

- 2.2 Construction Records. There are no construction records or as-built drawings available for this dam.

- 2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.

2.4 Evaluation

- a. Availability. There is no engineering data available. Past inspection reports and notes provide the only background data.
- b. Adequacy. The lack of hydraulic, structural and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on a visual inspection, a review of the past inspections reports, and engineering judgment.
- c. Validity. Comparison of the available inspection reports with the field survey conducted during the Phase I inspection indicates that the available information is valid.

WEST POND OUTLET

SECTION 3

VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at West Pond was performed on September 27, 1979. A copy of the inspection checklist is included in Appendix A. Previous inspections of the dam have been made by others in the past. Copies of these inspection reports are included in Appendix B.
- b. Dam. West Pond Outlet is a earthfill dam with a stone masonry core wall. It was found to be in poor condition, a condition that has been prevalent since the first recorded inspection in 1912. The top of the dam is extremely narrow and footpaths have been heavily worn on the crest. In one place erosion of the top has occurred indicating the dam has been overtopped (see photographs 3 and 4 in Appendix C). The upstream slope is nearly vertical and the downstream slope is steep (1-1/2:1 horizontal to vertical). The upstream slope has been eroded exposing the core wall. Considerable sloughing was noted on both slopes. The riprap on the upstream slope has been eroded. Past inspection reports state that the riprap formerly on the upstream slope began to slide into the pond in 1938. Both slopes are covered with a thick growth of brush and trees (see photographs 1 and 2 in Appendix C).

Evidence of extensive seepage was noted at the downstream toe. Flow was estimated to be 1 to 2 gallons per minute.

The abutments tie into natural ground. There is an outcrop of bedrock at the east abutment which forms the foundation of the spillway (see photographs 5 and 6 in Appendix C).

- c. Appurtenant Structures. At the east abutment of the dam, there is a 16-foot long, ungated, flat-crested weir which functions as the

WEST POND OUTLET

spillway. A rectangular notch, centrally located in the spillway, is 4.0 feet long, 0.3 feet deep and is at El 72.6. The crest of the main weir is at El 72.9. The spillway is constructed of mortared stone capped with concrete and is generally in poor condition. The mortar and stone are cracked, spalled, stained, and partially eroded. The spillway and training wall have separated and water is flowing through the separation (see photograph 7 in Appendix C). Water is also seeping through the spillway stonework. The eastern end of the spillway is founded on a rock outcrop, and water is flowing between the concrete and the rock (see photograph 6 in Appendix C). The outcrop serves as the floor of the spillway as well as the eastern training wall (see photograph 5 in Appendix C). The training wall on the western side of the spillway is constructed of concrete and tapers from a height of 2 feet at the weir to ground level approximately 15 feet downstream.

- d. Reservoir Area. The area around West Pond is sparsely developed except along the west shore where residences and unpaved streets have been built. The drainage area consists mostly of swamps and wooded hills. Slopes in the eastern side of the drainage area are 15 to 20 percent and in the western side are 5 to 10 percent.
- e. Downstream Channel. Discharge from the dam flows in the natural stream channel to a 24-inch diameter concrete culvert under Hesperus Avenue. The streambed is overgrown with trees and strewn with wood and other debris (see photograph No. 8 in Appendix C). The culvert is partially blocked with a board at the upstream end.

- 3.2 Evaluation. The above findings indicate that the dam is in poor condition and that there are deficiencies which must be corrected to assure proper performance of this dam in the future. It is evident that the dam is not adequately maintained. Recommended measures to improve these conditions are stated in Section 7.3.

WEST POND OUTLET

SECTION 4

OPERATING PROCEDURES

- 4.1 Procedures. Discussions with the Owner and with residents of the area indicate that there are no operating or maintenance procedures at the dam.
- 4.2 Maintenance of Dam. The dam is not maintained. Seepage is occurring at the toe of the earth embankment and through the spillway. Erosion of the embankment has occurred due to probable overtopping and poor maintenance. The riprap on the upstream slope has been eroded, exposing the core wall. There is localized slumping and bulging of the riprap throughout the downstream slope. There is a heavy growth of trees and brush on the dam and in the downstream channel. The downstream channel also contains wood and other debris.
- 4.3 Maintenance of Operating Facilities. The spillway is not maintained. The weir is cracked and eroded and water is seeping through both ends of the weir.
- 4.4 Description of Any Warning System in Effect. There is no warning system in effect at this dam.
- 4.5 Evaluation. There are no regular programs of maintenance or technical inspections at the dam. There is also no program for surveillance or a warning system in effect during periods of unusually heavy runoff. This is undesirable considering that the dam is in the "significant" hazard category. These programs should be implemented as recommended in Section 7.3.

WEST POND OUTLET

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. General. Drainage into West Pond originates in a swamp approximately 1,300 feet to the northeast and from hillsides to the east and west of the pond. The drainage area consists of 155 acres (0.24 square miles). The dam at West Pond is a 123-foot long, 12-foot high earthfill dam. The spillway is 16 feet long with a crest at El 72.9. A notched portion of the spillway is 4 feet long and at El 72.6. The spillway training wall leads to the natural stream channel downstream of the dam. There is no low level outlet at the dam.
- b. Design Data. There are no hydraulic or hydrologic computations available for the design of this dam. The available data indicates that the dam was originally built sometime before 1885. According to past inspection reports, plans for the reconstruction of the dam were submitted to the County for approval in 1885, and the work which took place a year later, was supervised. No information from this work is available.
- c. Experience Data. Hydraulic records are not available for this dam. Past inspection reports indicate that the dam has not been overtopped; however, the visual inspection indicated that the top of the dam had been eroded most probably by overtopping.
- d. Visual Inspection. The elevation of the notch in the spillway is very close to the elevation of the lowest point on the top of the dam. There is no low level outlet to draw down the pond in anticipation of a storm.

A more detailed discussion of the condition of the dam and appurtenances is given in Section 3, Visual Inspection.

WEST POND OUTLET

- e. Test Flood Analysis. West Pond Outlet has been classified as a "small" size dam of "significant" hazard potential. According to the Corps of Engineers' guidelines, a test flood ranging from a 100-year storm to a one-half probable maximum flood (PMF) should be used to evaluate the capacity of the spillway. For this investigation, the 100-year storm was used (approximately a one-quarter PMF).

The PMF rate was determined to be 2,200 cfs per square mile. This calculation is based on the average slope of the drainage area of 3.7 percent, the pond-plus-swamp area to drainage area ratio of 8.3 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). The guide curve for "rolling" topography was used to determine the peak flow rate. Applying the one-quarter PMF to the 0.24-square mile drainage area results in a calculated peak flood flow of 132 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 107 cfs (446 cfs per square mile), with the pond level at El 74.1.

Hydraulic analyses indicate that the spillway can discharge 1.2 cfs when the water surface is at El 72.8, which is the low point on the top of the dam. This discharge is only 1.1 percent of the outflow test flood.

During the test flood, the dam would be overtopped by a maximum head of 1.3 feet. Peak discharge over the top of the dam would be 3.8 cfs per foot of width at the low point. At critical flow, the depth would be 0.76 feet with a velocity of 5.0 feet per second.

- f. Dam Failure Analysis. Assuming a failure of the dam with the water surface at El 72.8, which is the low point on the top of the dam, the peak discharge would be about 2,385 cfs. Discharge from failure of the dam would produce an initial flood wave 9 feet high as opposed to a water depth of less than one foot prior to failure. At Hesperus Avenue, located 550 feet south of the dam, the flood wave

WEST POND OUTLET

would be 4.5 feet and probably cause damage to the houses located in the flood impact area. At a distance of 450 feet south of Hesperus Avenue the flood wave would be 5 feet deep. It would take about 0.29 hours to drain the pond down to El 62.0 at the toe of the embankment.

WEST POND OUTLET

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observation. The evaluation of the structural stability of West Pond Outlet is based on a review of previous inspection reports and the visual inspection conducted on September 27, 1979. As discussed in Section 3, Visual Inspection, the dam is considered to be in poor condition.

Seepage is occurring downstream of the toe of the dam and erosion has occurred on the top and slopes of the dam. The upstream slope has been eroded exposing the core wall, and on the downstream side the slope has bulged. A heavy growth of trees and brush is growing on the top of the dam as well as on the upstream and downstream slopes. There is leakage occurring between the spillway and the training wall, between the spillway and its bedrock foundation and through the stonework in the spillway. Serious seepage both at the spillway and downstream from the dam has been occurring for some time, according to past inspection reports.

- b. Design and Construction Data. The dam was originally built sometime prior to 1885 and reconstructed in 1896. Discussions with the Owner, County and State personnel indicate that there are no available plans, specifications or computation on the design, construction or repair of the dam. Information does not appear to exist on the type, shear strength, and permeability of the soil and/or rock materials of the embankment.
- c. Operating Records. There is no instrumentation of any type in the embankment at West Pond, and no instrumentation was ever reportedly installed in this dam. The performance of this dam under prior loading can only be inferred from physical evidence at the site.

WEST POND OUTLET

- d. Post-Construction Changes. There are no as-built drawings available for West Pond Outlet. Past inspection reports indicate that in 1886 a masonry wall was built about 2 feet downstream of the wall of the original dam and the space in between filled in with gravel. There is no mention of the extent of the walls or the presence of a cutoff. The original spillway is shown on a sketch in an early inspection report as being about 10 feet long with a 2-foot long notch containing a flash-board. In 1958, the spillway was replaced. Despite numerous inspection reports recommending repairs, there is no record of any other post-construction changes.
- e. Seismic Stability. The dam is located in Seismic Zone No. 3, indicating that there is a potential for major damage due to earthquakes in this area. This classification is based on the intensity of past earthquakes, and does not indicate the probability of such events in the future. The highest intensity earthquakes for this area were VII and VIII on the Modified Mercalli Scale, and occurred in 1727 and 1755, respectively.

Since there is no data available on the embankment or foundation materials, the seismic stability of the dam cannot be evaluated at this time. Severe seepage indicates that the dam may not be stable under static conditions. Considering that the dam is in the "significant" hazard category, an analysis of the static and seismic stability should be conducted by a qualified engineering consultant, as recommended in Section 7.2.

WEST POND OUTLET

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. Based upon a review of available data, and the visual inspection of the site, there are deficiencies which must be corrected to assure the continued performance of West Pond Outlet. Generally, the dam is in poor condition. Seepage was observed at the downstream toe of the dam, erosion has occurred on the top and slopes of the dam, the notch in the spillway is only 0.2 feet below the low point on the top of the dam and no low level outlet exists at the dam. In addition, the slopes of the embankment are steep, riprap is missing from the upstream slope of the dam and the core wall has been exposed by erosion on the upstream face of the embankment. Leakage is occurring between the spillway and the training wall and between the spillway and bedrock outcrop that forms the east abutment. A dense growth of trees and brush exists on both slopes of the dam and in the downstream channel.

Hydraulic analyses indicate that the existing spillway can discharge a maximum flow of 1.2 cfs with the pond at El 72.8, which is the low point on the crest of the dam. The peak test flood outflow (100-year storm) of 107 cfs will overtop the dam by a maximum of 1.3 feet. The spillway can discharge only 1.1 percent of the test flood before the dam is overtopped.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of this dam is based primarily on visual inspection, past performance and engineering judgment.

WEST POND OUTLET

- c. Urgency. The recommendations and remedial measures should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.
- d. Need for Additional Investigations. Additional investigations to further assess the adequacy of the outlet are outlined below in Section 7.2, Recommendations.

7.2 Recommendations. It is recommended that the Owner employ the services of a qualified engineering consultant to perform a detailed evaluation of the stability of the dam and a detailed hydraulic and hydrologic analysis. The evaluation should include the following items:

- a. A detailed investigation of the embankment and foundation materials to evaluate the static and seismic stability of the existing dam.
- b. A detailed investigation and evaluation of the wet areas and seepage downstream of the dam.
- c. The feasibility and method of repairing or reconstructing the embankment including the selective clearing of brush and trees.
- d. Design of an adequate spillway and low level outlet for the dam.

The Owner should immediately drain the pond by acceptable means and breach the dam until the recommendations of the engineering consultant have been implemented. Lowering of the pond should be conducted under the supervision of an engineer.

7.3 Remedial Measures

- a. Operating and Maintenance Procedures. It is recommended that the Owner accomplish the following:

WEST POND OUTLET

- (1) Implement a systematic program of maintenance inspections. As a minimum, the program should include monthly inspections of the dam and appurtenances, supplemented by additional inspections during and after severe storms. Maintenance should include repair of erosion and clearing of vegetation on the slopes of the embankment and clearing of debris from the spillway and outlet. All repairs and maintenance should be made in accordance with all applicable State regulations. However, modifications to the dam and appurtenances should not be made until studies by an engineering consultant are completed.
- (2) Conduct technical inspections of this dam on an annual basis.
- (3) Implement a plan for surveillance of the embankment during and after periods of unusually heavy runoff and a plan for notifying downstream residents in the event of an emergency at the project.

7.4 Alternatives. An alternative to the recommendations and remedial measures discussed above is to permanently drain the pond and breach or remove the dam.

WEST POND OUTLET

APPENDIX A
PERIODIC INSPECTION CHECKLIST

WEST POND OUTLET

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT WEST POND OUTLET

DATE 9/28, 9/27/79

TIME 14:00

d/s = downstream

u/s = upstream

WEATHER Sunny-Clear

W.S. ELEV. 72.1 U.S.n/a DN.S.

* based on assumed bench mark
at El. 73.0 on highest point
on top of spillway.

PARTY:

- | | |
|-----------------------|-----------|
| 1. <u>L. BRANAGAN</u> | 6. _____ |
| 2. <u>W. CHECCHI</u> | 7. _____ |
| 3. <u>M. LARSON</u> | 8. _____ |
| 4. <u>P. REILLY</u> | 9. _____ |
| 5. <u>J. RISITANO</u> | 10. _____ |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>DAM</u>	<u>LARSON/RISITANO</u>	
2. <u>SPILLWAY and OUTLET</u>	<u>BRANAGAN/LARSON/RISITANO</u>	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECK LIST

PROJECT West Pond Outlet DATE 27 Sept. 1979

PROJECT FEATURE Dam Embankment NAME Larson

DISCIPLINE Geotechnical NAME Risitano

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Varies from 73.4 to 75.2
Current Pool Elevation	72.1
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible
Pavement Condition	N/A
Movement or Settlement of Crest	Embankment widened and raised at right abutment
Lateral Movement	Crest not visible due to vegetation, d/s face lateral movement throughout
Vertical Alignment	includes dislodged stone & buldging. Undulating
Horizontal Alignment	Apparent curvature and center of dam d/s
Condition at Abutment and at Concrete Structures	Fill placed at right abutment; left abutment rock outcrop.
Indications of Movement of Structural Items on Slopes	Buldging and voids in riprap protection.
Trespassing on Slopes	Footpaths heavily worn on crest
Sloughing or Erosion of Slopes or Abutments	25 ft. west of spillway and adjacent to spillway
Rock Slope Protection - Riprap Failures	Stone on U/S slope dislodged throughout core wall exposed, localized buldging on d/s slope.
Unusual Movement or Cracking at or near Toes	Localized buldging throughout d/s face, buldging d/s adjacent to spillway, voids 1 ft. deep.
Unusual Embankment or Downstream Seepage	25 ft. west of spillway at d/s toe
Piping or Boils	None visible
Foundation Drainage Features	None visible
Toe Drains	Unknown
Instrumentation System	None visible

PERIODIC INSPECTION CHECK LIST

PROJECT West Pond Outlet DATE 27 Sept. 1979

PROJECT FEATURE OUTLET WORKS NAME Larson

DISCIPLINE Geotechnical NAME Risitano

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	Covered with debris
General Condition	Poor
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some
Floor of Approach Channel	Submerged, not visible
b. Weir and Training Walls	Flat crested
General Condition of Concrete	Generally poor, concrete weir on top of mortared stone, heavily cracked top deteriorated and eroded, separation at training walls from spillway
Rust or Staining	d/s face of weir at right training wall
Spalling	Evident throughout
Any Visible Reinforcing	None visible
Any Seepage or Efflorescence	3-5 gpm estimated flowing through at base of spillway weir
Drain Holes	None visible
c. Discharge Channel	
General Condition	Very poor; rock, timber, debris throughout
Loose Rock Overhanging Channel	Some
Trees Overhanging Channel	downed trees
Floor of Channel	ledge for 25 ft., then soil covered with heavy vegetation
Other Obstructions	Partially blocked culvert d/s at Hesperus Avenue

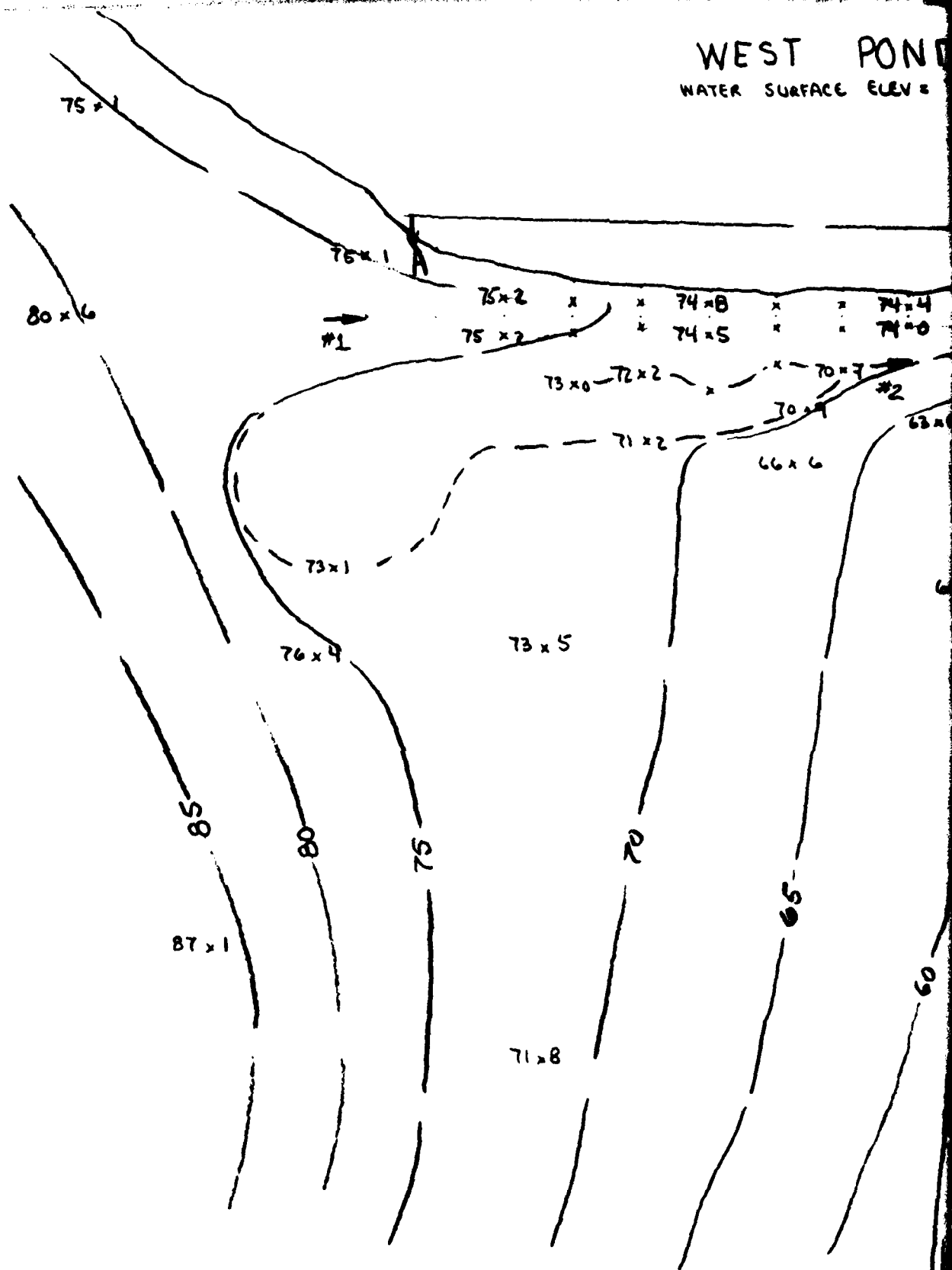
APPENDIX B
PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

	<u>Page</u>
Figure B-1, Plan of Dam	B-1
Figure B-2, Sections Through Dam	B-2
Notes from Previous Inspections by Essex County Engineers 1912-1969	B-3
Inspection Report by Massachusetts Division of Waterways	B-14

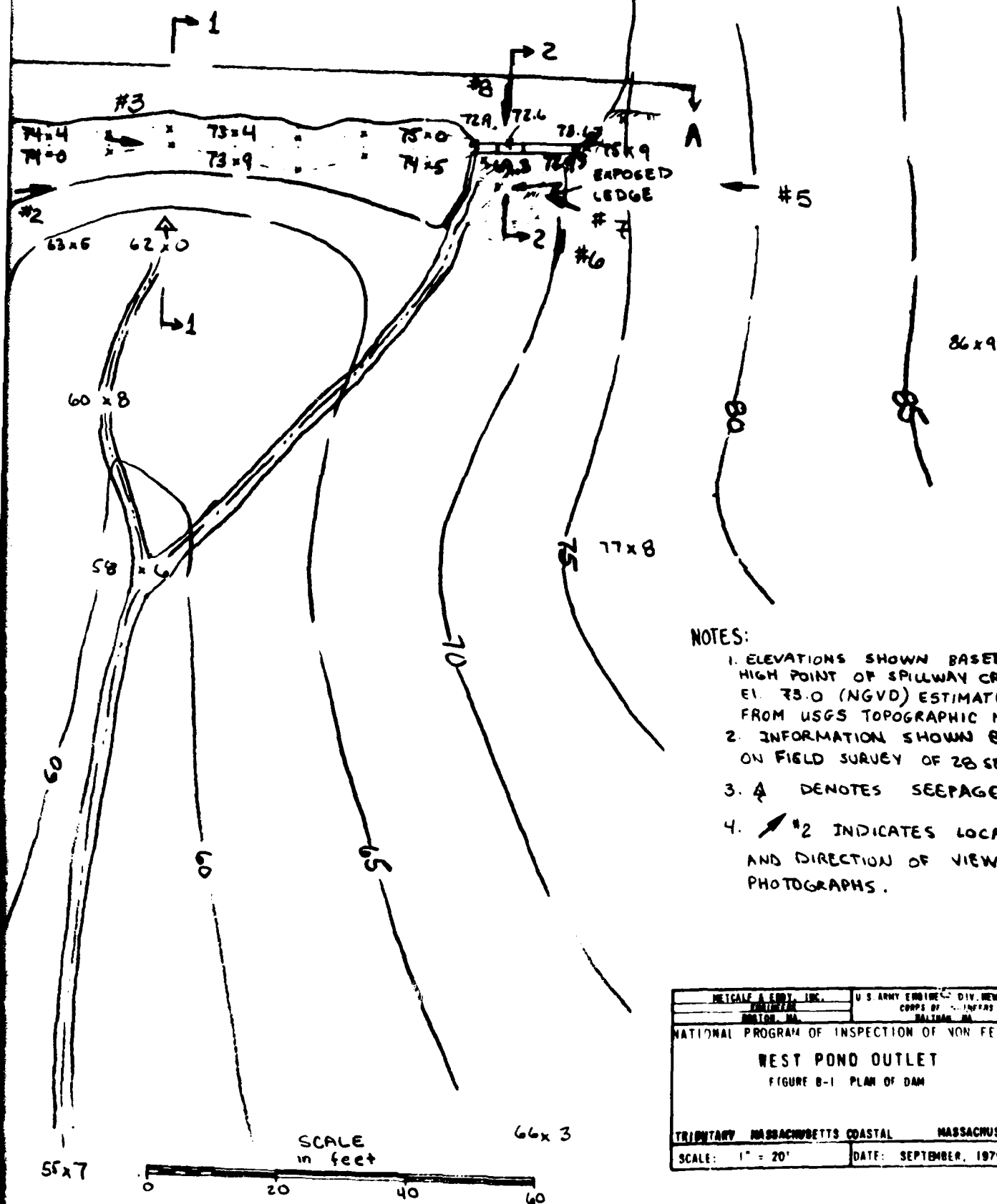
WEST POND OUTLET



WEST POND

WATER SURFACE ELEV =

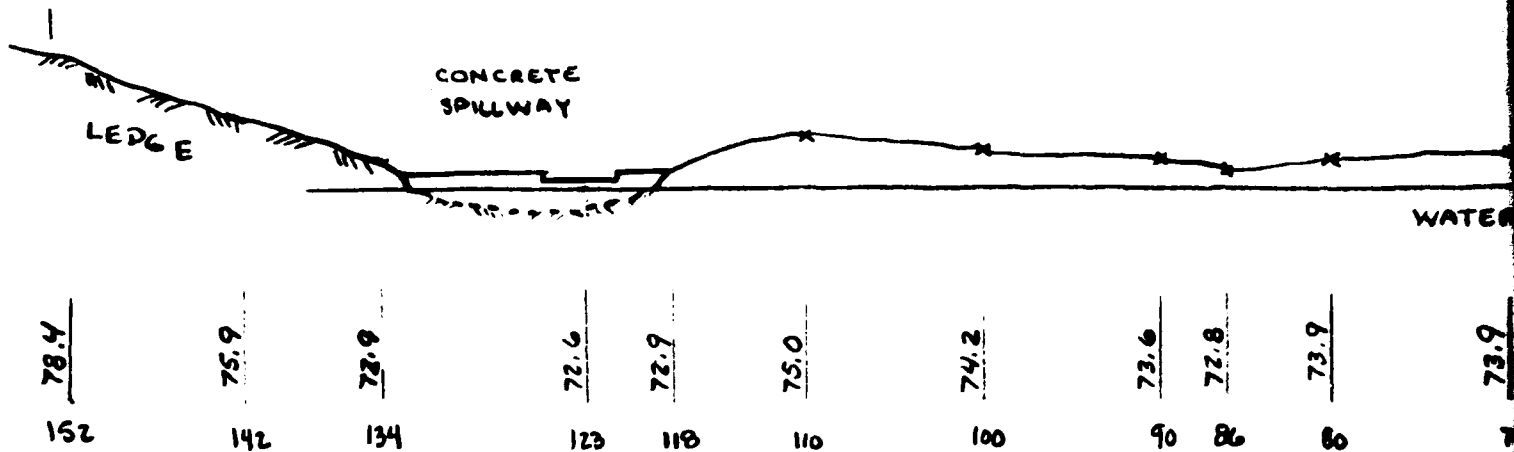


METCALF & EDDY, INC.

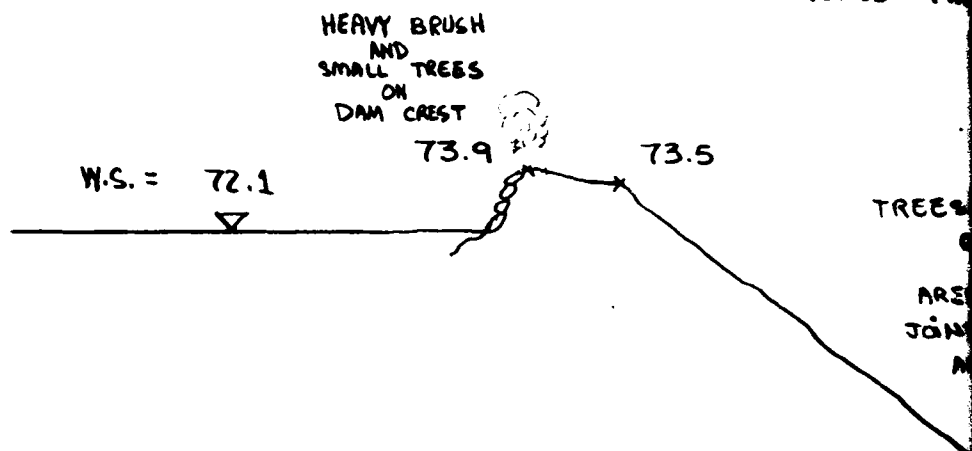


1. ELEVATIONS SHOWN BASED ON HIGH POINT OF SPILLWAY CREST EL. 73.0 (NGVD) ESTIMATED FROM USGS TOPOGRAPHIC MAP.
2. INFORMATION SHOWN BASED ON FIELD SURVEY OF 28 SEPT. 1979.
3.  DENOTES SEEPAGE
4.  #2 INDICATES LOCATION AND DIRECTION OF VIEW FOR PHOTOGRAPHS.

METCALF & EDDY, INC. ENGINEERS BOSTON, MA.		U.S. ARMY ENGINEERING DIV. NEW ENGLAND CORPS OF ENGINEERS BOSTON, MA.	
NATIONAL PROGRAM OF INSPECTION OF NON FED DAMS			
WEST POND OUTLET			
FIGURE B-1 PLAN OF DAM			
TRIBUTARY		MASSACHUSETTS	COASTAL
SCALE: 1" = 20'		DATE: SEPTEMBER, 1979	



PROFILE
DAM
SCALE 1 in. = 5 FT

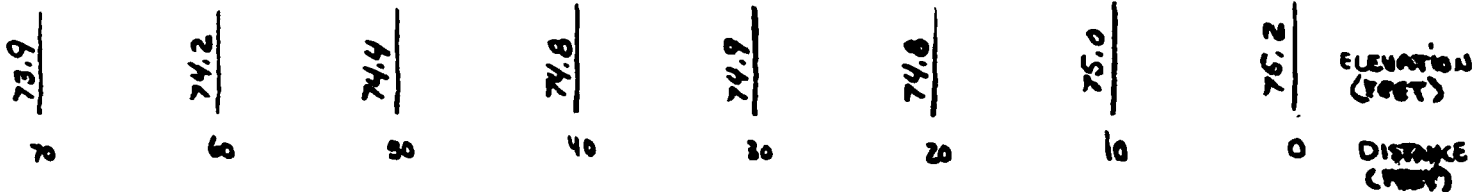


SECTION 1-1
DAM EMBANKMENT
SCALE 1 in. = 5 FT

METCALF & EDDY, INC.

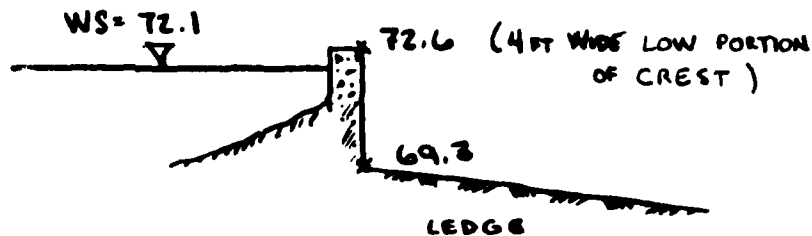
2

WATER LEVEL = 72.1



FILE A-A
 AM CREST
 1 in. = 10 FT.

TREES AND BRUSH
 ON SLOPE
 AREAS OF OPEN,
 JOINTED FIELDSTONE
 ALSO APPARENT
 ON SLOPE



SECTION 2-2
 SPILLWAY
 SCALE 1 in. = 5 FT.

62.0 (SEEPAGE STREAM BEGINS)

SCALE
 in feet



DETCON & SONY, INC.	U.S. ARMY ENGINEER DIV. NEW ENGLAND
BOSTON, MA	CORPS OF ENGINEERS
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
WEST POND OUTLET	
FIGURE B-2 SECTIONS AND PROFILES OF DAM	
TRI-STATE MASSACHUSETTS COASTAL	MASSACHUSETTS
SCALE: AS SHOWN	DATE: SEPTEMBER, 1979

O 105-5-C

D 13 R S P

COUNTY OF ESSEX, MASSACHUSETTS
ENGINEERING DEPARTMENT
Inspection of Dams, Reservoirs, and Stand Pipes

9855 14
O 108-51
SUB NUMBER
D 13 R S P
Reg. No. 494-1

Inspector C. C. Barker Date April 24 1912 Classification I
City or Town Gloucester Location Old Stanwood Dam end of Woods Road
Norman Ave off of Magnolia Ave Magnolia
Owner Controlled by Cape Pond Ice Co. Use Ice Pond

Material and Type Earth and stone (about 15' high) (see below)
Masonry Core Wall

Elevations in feet: above (+) or below (-) full pond or reservoir level. (Cross out what does not apply.)
For Dam
Bed of stream below Bottom of pond Bottom of spillway Top of dam Top of flash boards
For Res. or S. P.
Ground surface below Bottom of res. Level of over flow pipe Top of res.
For dam
Length in ft. 150 Top width in ft. 5 Pond area 13± acres Area of watershed 75± acres
For Res. or S. P.
Inside dimensions Capacity Covered open

Length of overflow or spillway Outlet pipes (size and nature)

Stand pipe, thickness at base diam. of river head Pitch 1 in 100

Foundation and details of construction gully about 5' below top of dam

Constructed by and date about 1880 and in ledge

Recent repairs and date about 1880

Evidence of leakage and below is wet & there is quite a little leakage of the stone bulge out a foot or so

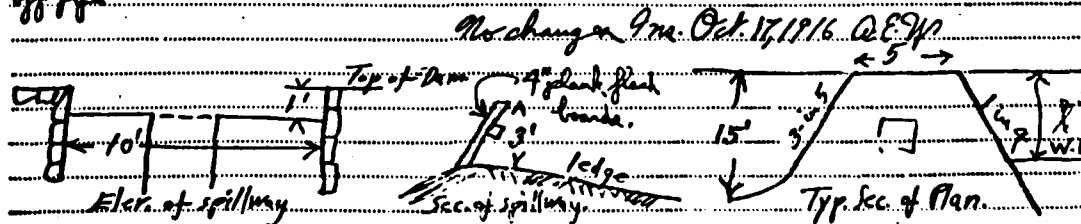
Condition Fair except that the gully is rotting out also 5' below top of dam

Topography of country below Narrow valley (woody)

Nature, extent, proximity, etc. of buildings, roads or other property in danger if failure should occur 4 or 5 houses below would be damaged

Plans and data secured or available Plan on file in Clerk of courts office Salem.

Use separate sheet for sketches if necessary.
Notes, sketches, sections, etc. Max. depth of water 14 ft ± The spillway is about 10' wide & comes within 1 foot of the top of dam down slope of spillway is ledge. There are indications of a stone masonry core wall. The down stream slope is paved with large & small field stone & is covered with brush. The up stream is paved large & small stone & is covered with brush together. There is a 5" iron draw-off pipe.



*Classify as to probable damage in case of failure. 3 slight. 2 moderate. 1 serious.

Gloucester D. 13

1917, March 26. Watershed 0.1 sq. m. Max. Ht. 14.0 ft. Apparent condition, Fair.

1925, Oct. 29. R. R. Evans, Insp. Dam at Magnolia, Cape Pond Ice Co., owners. This is an earth filled dam between rubble walls and is of considerable height. The spill way at the easterly end is in the natural rock. The walls are of rough quality and the cross section is narrow for its height and type and character of construction. No flash boards are in place in the spill way and without these it would seem that the dam and spillway should be sufficient. Flash boards have been used here at times in the past, and if maintained in flood conditions might endanger the structure which, in case of failure, would cause some damage to roads below but probably not to any buildings, and it is only a short distance to the sea.

Plans and specifications for work at this dam were approved by the County Commissioners in 1885 and work supervised.

1885 Copy of Inspections and specifications See 0108-5-C - 1930.

1925 Report to Co. Comm. Same as above (1925, Oct. 29)

1928, Oct. 4. C. C. Barker, Insp. Dam at end of Woods Road off Norman Avenue, Magnolia, is owned by Henry West, but the Cape Pond Ice Company have a mortgage on it. This pond is not in use but was formerly used by the Cape Pond Ice Company. I did not see the owner, Mr. West. Below this dam is a narrow woody valley in which there are four or five houses. There would be quite a little damage in case of failure and probably loss of life. There have been no changes since the last inspection and the conditions are the same. The dam is covered with brush and trees which should be cut. The spillway is more or less cluttered up with rubbish. The spillway is three feet below the top of the dam. The lower side of the dam is wet and looks like there is leakage. The pond is full of water today.

1928 Nov. 30 R. R. Evans Insp (See back of sheet)

1928 Report to Co. Comm. Dam at Magnolia at the end of Wood's Road off Norman Avenue is owned by Henry West. It is of earth behind a rough rubble stone wall and of rather thin section for its height, showing considerable percolation in the land below it, but there has been no apparent deterioration since last examined and there seems to be now no opportunity to place flash boards in the spillway, and without these I see no reason to anticipate any trouble.

1930, Sept. 16. C. C. Barker, Insp. Dam at end of Wood's Road off Norman Avenue, Magnolia, is owned by Henry West. This pond is not in use now, but was formerly used by the Cape Pond Ice Company. I gave a copy of the notice to Mr. West, who went to the dam with me. Below this dam is a narrow woody valley in which there are several houses. There would be quite a little damage in case of failure, and probably loss of life. There have been no changes since the last inspection, and the conditions are the same. The dam is covered with brush and trees which Mr. West intends to cut this fall. The timber portion of the old spillway is all gone. The land below is wet and it looks like leakage. Mr. West says the land is full of springs and there is a 4 foot core wall in the dam. The dam is in fair condition. The water level is 4 feet below the top of the dam.

1930, Nov. 10. R. R. Evans, Insp. Rather poor around spillway.

WEST POND OUTLET

Gloucester D. 13

Rubble masonry - Pond small - Little chance of anything in nature of collapse. Valley below would retard any flood wave.

1930 Report to Co. Comm. A dam off Norman Ave. in Magnolia at the end of Woods Road is owned by Henry West, and from its location considerable damage might follow failure, but the pond is not large and the shape of the valley below would tend to somewhat retard the flow. The lower side of this dam is a rubble masonry wall and a considerable seepage shows below. The records in the office of the Clerk of the Courts show that in 1886 a wall about two feet thick was built below the old dam and a space two feet wide between the old and new walls filled with gravel. The spillway at the north end is on solid rock. The form of construction leaves much to be desired but no signs of failure are apparent and the structure seems to be in fairly good condition.

See D101-S-C 1930 for examination of dam in 1885 by Putnam

1932, Aug. 2. C. C. Barker, Insp. I saw Mr. West. The timber spillway is in rather poor shape. Top is about 2 feet below the top of the dam. The water level is about 3.5 feet below the top of the dam. The pond is not used for cutting ice. The conditions are the same and there has been no change.

Spillway about 2 feet lower than in 1930.

1932, Nov. 2. R. R. Evans, Insp. This dam was approved in 1930 partially because all stop plank had been removed from the spillway. A log about 1' in diameter is now across the spillway, apparently placed there intentionally, and considerable floating timbers are left directly behind it. The pond is full and overflowing, so practically none of stone wall from up-stream side of dam can be seen. Unless spillway is to be kept open for its full depth, the dam should be raised and strengthened, since it is of some importance, both as to height and amount of water held back, and uncertainties as to just what would result from failure are too great to take chances.

1932 Report to Co. Comm. Stanwood Dam off Norman Ave. near Magnolia Ave., in the part of Gloucester known as Magnolia, was reported to you in 1930 as in fairly good condition and I then recommended no repairs or alterations. In arriving at the conclusions on which that report was based I was influenced considerably by the fact that all the stop plank in the old spillway had been removed, and the full pond level was correspondingly lowered. In my inspection this year I find that a log has been placed in this spillway, apparently purposely to raise the level of the water, and at the time of inspection there was some drift wood behind this log. If it be the intention of the owner to so raise the pond level even for a part of the time, he should be required to raise the top of the dam and increase the thickness of the embankment. It may be that an extensive collapse of the dam would not cause any very serious damage to a road or bridge, or cause loss of life, but there is enough uncertainty in the situation so that I would recommend that he be required either to remove all stop plank or anything else which can in any way obstruct the waste way and to keep it clear at all times, or to raise the top of the dam and increase its thickness. Repairs within any case be necessary within a short time as the dam has less width in cross section than is usual and the rubble masonry walls will soon need attention.

WEST POND OUTLET

1928 Nov 30. R. R. Evans Insp. The condition is as Mr. Barker reports and same as at my last inspection, except that there seems to be no opportunity now to put in flash boards. Without flash boards there should be no danger, although construction of dam is very rough and section seems thin for the height and nothing of internal construction is known.

Gloucester D. 13.

1934, Sept. 27. C. C. Barker, Insp. I gave a copy of the notice to Mr. West's son, he did not go to the dam with me. This dam is the same, there are some trees and bushes that should be cut. There is quite a little seepage same as when last inspected. The water level is 3.5 feet below the top of the dam or 2 feet below the top of the spillway.

1934, Dec. 12. R. R. Evans, Insp. Stop logs are in place and holding back water to extra depth probably one foot or more. Dam is not suitable for this condition. It should be made thicker and higher.

1934 Report to Co. Comm. Stanwood Dam off Norman Avenue near Magnolia Avenue has been unfavorably commented upon in the past. So long as there were no stop plank in the old spillway alterations did not seem to be imperative but in my last previous report it had been found that stop plank were then being used, and it was there recommended that the owner be required either to remove all stop plank and keep the waste way clear at all times, or to raise the top of the dam and increase its thickness. The use of the stop plank has continued and they are in place at the time of this report. Since it is the evident intention to keep them in use I would recommend that the dam be raised so as to be three or four feet above the height at which the water level is to be maintained, and that it be very materially strengthened, probably by increasing the thickness on the lower side with proper material.

1936 August, 10, C.C.Barker, Insp. I did not see the owner. This dam is in about the same condition. There is a great amount of seepage. The ground at the toe of the slope is very wet and rusty. Some stones along face wall on the upper side are out. It looks as if a few stones had been dumped on lower face at westerly end. The water level is about 3.0 feet below the top.

1936 Report to Co. Comm. Conditions at Stanwood Dam, belonging to Henry West, in the Magnolia section are unsatisfactory and have been previously so reported. The dam should be raised and strengthened.

1938 October 26, C.C.Barker, Insp. This dam is now owned by Mary B. West, wife of Albert West. I gave a copy of the notice to Mrs. West. This dam is in about the same condition. Most of the bushes have been cut. There is some seepage. There are some logs and debris in the spillway. The water level is 2.5 feet below the top of the dam. At the west side of the spillway on the lower side, the stone face is in poor shape and the water from the spillway is cutting underneath the wall and in time it might be undermined. Mr. Henry West, former owner, does not think this could happen as the core wall is well cemented to the ledge foundation at the spillway.

1938 November 2, R.R.Evans, Insp. With Mr. Barker inspected Stanwood's Dam in Magnolia. There is some rubbish and floating timbers in the spillway, and it would appear that not much effort is made to keep this clear. Some stone are falling out from the steep paving on the water side of the dam at the top, and this embankment is very narrow with some washing at points where these stone are loose, so that with very little freeboard normally existing water might cut gullies in the top of the dam. Conditions below the dam are apparently substantially as in previous reports.

Gloucester D. 13

1938 Report to Co. Comm. The Stanwood Dam in the Magnolia section of Gloucester is not in satisfactory condition. In years past my reports have stated this, and the necessity of keeping the spillway open and unobstructed has been emphasized, since the dam, which is of earth and rubble, is of narrow cross section and the top is very little above the crest of the spillway. Although at recent inspections we have sometimes found the spillway open and unobstructed as it should be, at the time of our inspection this year and at other times we have found a log placed across it with the evident intention of raising the level of the pond. The top of the dam has not been kept up as it should be and some stone are falling out. Following the last previous inspection I recommended that the dam be raised and strengthened and I now repeat that recommendation.

1940 Oct. 2, C.C.Barker, Insp. I saw Mrs. West, the owner of this dam. This dam is in the same condition. Stone are put in the upper face wall and there is much seepage. The spillway is somewhat blocked with floating material. The water level is 3' 9" below the top of the dam.

1940 Report to Co. Comm. In several of my most recent reports I have stated that Stanwood Dam, off Norman Avenue near Magnolia Avenue, was not in satisfactory condition and it has further deteriorated since then. There is insufficient free board above spillway level, the cross section is thin for its height and form of construction. It is not in good condition and little effort seems to be made to keep the spillway clear. There is danger that it may fail in whole or in part, and much uncertainty as to just how serious the results of a failure might be.

1942 July 31, C.C.Barker, Insp. I did not see the owner of this dam, as no one was at the house. This dam is in about the same condition. The upper face wall is in poor shape. More stones have fallen or been pushed out. There is a great amount of seepage. The spillway is composed of logs with stones cemented together on top of these. The top of the spillway is 2 feet below the top of the dam and about 13 feet long. In this spillway is a notch about one foot deep and 2 feet long, so the water level is about 3 feet below the top of the dam. This spillway is on ledge at the easterly end of the dam and there is still some floating material in the spillway that might block the spillway and cause an overflow of the dam. There has not been any change.

1942 Report to Co. Comm. The Stanwood Dam, off Norman Avenue near Magnolia Avenue, is not in satisfactory condition, as has been previously reported. The spillway is such that it may be easily blocked by floating material, and the dam might be overtopped and the earth easily washed away as the upper face wall and dam are not in good condition. There is some uncertainty as to what damage would be done by failure of this dam.

1944 July 27, S.W.Woodbury, Insp. I gave a copy of the notice to Mr. West at his restaurant at Cole Square, Magnolia. I visited the dam alone. The water level is 0.4 ft. below the lip of the spillway. A 10" x 14" log about 15 ft. long and a lot of other lumber is obstructing the spillway just above the dam. A lot of lumber has also washed over the dam and is now piled up below. There are many leaks at bottom of slope below the dam which cannot be seen very plainly as there are many bushes on the slopes. The dam is in very poor condition. (See sketch on the back of sheet 1.).

Gloucester D. 13

1944 Report to Co. Comm. The Stanwood Dam, off Norman Avenue west of Magnolia Avenue, as previously reported, is in an unsatisfactory condition. The spillway is inadequate and may be easily blocked by floating material and cause an over-topping of the dam and wash away the narrow embankment. The amount of damage that would be done by failure of the dam is uncertain.

1946 Sept. 24, S. W. Woodbury, Insp. I gave a copy of the notice to Mrs. West and went to the dam alone. Further inspection is needed to see that debris is cleaned out of spillway. Water level today is 0.4' below crest of spillway. Leaks are same as last reported. Condition of dam is very poor. Spillway is full of debris. Mr. West says he will clear this away.

1946 Report to Co. Comm. The conditions at the Stanwood Dam, off Norman Avenue, remain about the same, very unsatisfactory. There is about the same amount of leakage. The spillway, obstructed with much debris, should be kept clear to allow greater spillway capacity to prevent the dam from being overtopped.

1948 Sept. 30, S. W. Woodbury, Insp. Did not see owner and went to dam alone. Water level today: 1.0' below crest of spillway. Condition of dam is the same. Plenty of debris in spillway still.

1948 Report to Co. Comm. At Standooow Dam, off Norman Avenue, no improvements have been made. The spillway of limited capacity is still more or less obstructed with debris. The spillway should be kept clear as a precaution against overtopping of this high and narrow dam.

1950 Sept. 27, S. W. Woodbury, Insp. I left a copy of the notice for Mayor John J. Burke, Jr., at his office and went to dam alone. Water level today: 1.5 ft. below crest of spillway. Condition of the dam is the same. Mr. West says that the Mayor of Gloucester owns the dam now.

1950 Report to Co. Comm. The Stanwood Dam, off Norman Avenue, is now owned by John J. Burke, Jr. As the spillway of this dam has a limited capacity, it should be kept clear of all debris which is not the case, and the embankments should be kept in good condition as a precaution against washing.

1952 Sept. 25, E. H. Page, Insp. Went to dam alone. Water level today: 1 ft. below crest of spillway. Some seepage at the toe. Spillway filled with debris.

1952 Report to Co. Comm. The Stanwood Dam, off Norman Avenue, Magnolia, has a spillway of limited capacity which is always filled with more or less debris which might cause the dam to be overtopped and serious damage might result. The dam and spillway should be kept in good condition.

1954, May 28, E. H. Page, Insp. Leaks: Very wet at toe. Minimum freeboard: 2' ±. Entrance and exit clogged with debris. Erosion of banks: Very bad, one place top is only 3 ft. wide, orig. about 6'. Rubble masonry spillway is disintegrating and falling into stream bed. It must be 10" or 12" lower now than originally.

(Atten. Insp. Take next avenue to Ocean St. by the high wall).

1954 Report to Co. Comm. Stanwood Dam, on Woods Road north of Norman Avenue in Magnolia, is in very poor condition. The spillway is inadequate and filled with debris which cuts down the capacity even more. The rubble masonry is disintegrating and falling into the stream. The slopes are very badly eroded. In one place the top of the dam is now only three feet wide, where originally it was about six feet. There is a great deal of leakage at the toe where it is continually wet. This dam could easily be overtopped and serious damage would result. The dam and spillway should be repaired and kept in good condition.

1955, April 21, E.H. Page & J.O. Harmaala, Insp. Owner: J.J. Burke (as of record) Mrs. Mary West (claims she owns it). No provision for flashboards. Some small rocks have been piled up in the spillway to raise water level. Wall on pond side of dam has fallen in one place and the dam is only 3' + wide here. This is very near the highest part of the dam. - Pictures were taken.

1956, Sept. 12, E.H. Page, Insp. Owner: Burke or West. Obstructions in spillway: Stones and debris. Erosion of Banks: Very bad in one place. Top of dam only 2' wide here. Condition: Extremely poor condition. There is an extremely serious situation here as this is quite a high dam and a deep pond.

1956 Report to Co. Comm. At Stanwood Dam, off Woods Road, north of Norman Avenue, in Magnolia, an extremely dangerous condition exists. The wall on the pond side in one place has fallen into the pond and the dam is less than three feet wide here. This is very near the highest part of the dam. Some stones have been placed in the spillway to increase the height of the water. This obstruction tends to collect debris and further impede the flow and increase the danger of overtopping. The dam and spillway should be repaired and kept in good condition.

1958, Jan. 29, E.H. Page & A.A., Insp. Elev. of water: 5" over spillway slot. Height of flashboards 0". The bad place in the middle of the dam, as previously reported, is worse. Some attempt has been made to place some new rocks on the upstream face, but work was stopped before any real good was accomplished. Water running over Norman Avenue and Hesperus Avenue where culverts are either inadequate or too small.

1957, Oct., E.H. Page & J.O.H., Insp. Elev. of water: 1.5 below spillway. Height of flashboards 6". Minimum freeboard: 0.8. Debris should be removed above dam and kept cleaned out. Clean out dirt both sides of new conc. and replace stones. The end of dam next to new conc. should be built up with stone and mortar. Clean out debris. Build up stone and mortar at Gloucester end of new conc. The dam should be built up its entire length at least to 2 ft. above highest part of new conc.

1958, Dec. 30, E.H. Page, & K.M. Jackson, Insp. Elev. of water: 1/2" over one end of conc. Height of flashboards: 6" Lot of debris downstream of spillway. This dam is getting critical. The upstream side of the dam in one place has eroded to a rubble and mortar core wall which is bulging badly. A new conc. spillway has been built since

last inspection. Not good design.

1958 Report to Co. Comm. Stanwood Dam, off Woods Road north of Norman Avenue, is in extremely dangerous condition. The upstream side of the dam in one place has eroded to a rubble mortar core wall which is tipping downstream and bulging the downstream wall. Many of the stones in the wall and the upstream side of the dam have fallen in the pond. This exposes the earth fill to wave action. A new concrete spillway has been built since the last inspection. This spillway is too small and the freeboard is inadequate. There is a lot of debris downstream of the spillway.

1961, March 10, E.H. Page & P.D. Killam, Insp. Condition: Same.

1960 Report to Co. Comm. Stanwood Dam, off Woods Road north of Norman Avenue, is in extremely dangerous condition. The upstream side of the dam in one place has eroded to a rubble mortar cor wall which is tipping downstream and bulging the downstream wall. Many of the stones in the wall and the upstream side of the dam have fallen in the pond. This exposes the earth fill to wave action. The spillway is too small and the freeboard inadequate. There is a lot of debris downstream of the spillway.

1962 Dec. 19, K.M. Jackson, Insp. Owner: John J. Burke, Jr. No repairs since last inspection. Conditions below dam: Full of debris. Elev. of water: water going over the westerly end of spillway and piping around the easterly end of wall. Height of flashboards: about 8'. Minimum freeboard: None. Obstructions in spillway: Full of debris. Erosion of banks: Same as previous report. Condition of dam: Poor. Same as last report. Fill and stone riprap, where dam is eroded, exposing core wall.

1962 Report to Co. Comm. Stanwood Dam, off Woods Road, north of Norman Avenue, is in extremely dangerous condition. The upstream side of the dam in one place has eroded to a rubble mortar core wall which is tipping downstream and bulging the downstream wall. Many of the stones in the wall on upstream side of the dam have fallen into pond. This exposes the earth fill to wave action. Water going over the westerly end of spillway and piping around the easterly end of dam. This spillway is too small and the freeboard inadequate. There is a lot of debris downstream of spillway.

1964 Dec. 29, P.D.K. & K.M.J., Insp. The westerly wingwall at the spillway has been repaired. The riprap on the upstream side of the dam needs to be reset. Stone have fallen away exposing the earth to wave action.

1964 Report to Co. Comm. The westerly wing wall at the spillway has been repaired. The riprap on the upstream side of the dam is in need of repair. Many stones have fallen into the pond exposing the earth dam to wave action which is eroding the earth dam. The considerable amount of debris at the entrance to the spillway should be cleaned out.

1966 April 17, 1967. P.D.K. & K.M.J., Insp. Same conditions exist regarding riprap on face. The downstream face is falling away.

Gloucester D. 13

D. 13 Sh. 8

1966

Report to Co. Comm. This dam should be repaired. The top of the earth embankment is being worn down by foot traffic. This should be filled and leveled. The downstream face has fallen away in one place about 12-15 feet in length. This conditions should be repaired. The riprap on the upstream side should be re-set.

1968 March 25, 1969. P.D. Killam and J. Fitzgerald. The water was very high with 5 inches going over the spillway. At this elevation there is only about 3 inches of freeboard. The riprap should be reset and the top of the dam should be leveled and widened using the west end as a base.

D 13 —

GLoucester

5-5-107-13

L.E. WILKINSON

7/13/71

1

0.5 WEST POND. BEGIN ON NORMAN AVENUE AT LAKE ROAD.
TAKE LAKE ROAD 500 N.F. NORTH. DAM IS 400 L.F. EAST OF LAKE RD.
(1-4-68) BK. 5503
ESTATE OF ARNOLD L. MORTON R. 179 HESPERUS AVE. P. 164
PLEASURE POND

EARTH BETWEEN ROCK WALLS

14.0 ± FT.

150.0 ± FT.

5.0 FT.

13.0 ± ACRES

75.0 ± ACRES

PLAIN CEMENT CONCRETE WALL 12" THICK AND 24" HIGH SET ON TOP OF STONE MASONRY WALL WHICH HAS A MAXIMUM HEIGHT OF 24" AND IS BUILT ON SILT LEDGE. THIS MASONRY WALL IS LEAKING QUITE FREELY BETWEEN ITSELF AND THE LEDGE. THE CONCRETE WALL HAS A NOTCH THROUGH IT 48" LONG AND 6 1/2" DEEP. THE TOP OF THE CONCRETE OF THE MAIN WALL IS ABOUT 24" BELOW TOP OF DAM. THE WATER LEVEL IN POND TO-DAY IS 12" BELOW TOP OF CONC. SPILLWAY WALL AT WEST END. TO-DAY FREEBOARD OF DAM ITSELF IS 36".

BRUSH SHOULD BE CUT & TWO SMALL TREES ON WEST END OF DAM SHOULD BE REMOVED. THERE IS ONE BAD WASHCUT ABOUT 25 FT. WEST OF SPILLWAY ON DOWN STREAM FACE WHICH LEAVES THE THICKNESS OF THE TOP OF THE DAM AT THIS POINT ABOUT 24". THIS SHOULD BE REPAIRED IMMEDIATELY. THE LEAKS AT THE SPILLWAY SHOULD BE REPAIRED HOWEVER, WITH THE PRESENT CONDITION OF THE DAM, MAYBE THESE LEAKS ARE A GOOD SAFETY VALVE TO KEEP THE WATER LEVEL EVEN BELOW SPILLWAY LEVEL.

WEST POND OUTLET

APPENDIX C

PHOTOGRAPHS

(For location and direction of view of photographs, see
Figures B-1 and B-2 in Appendix B.)

WEST POND OUTLET

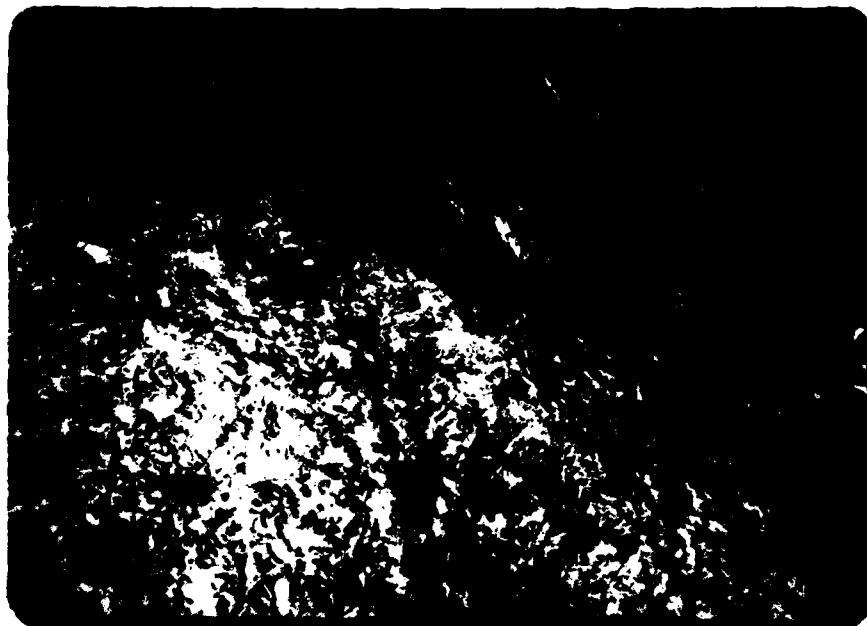


NO. 1 VIEW EASTWARD ALONG TOP OF DAM

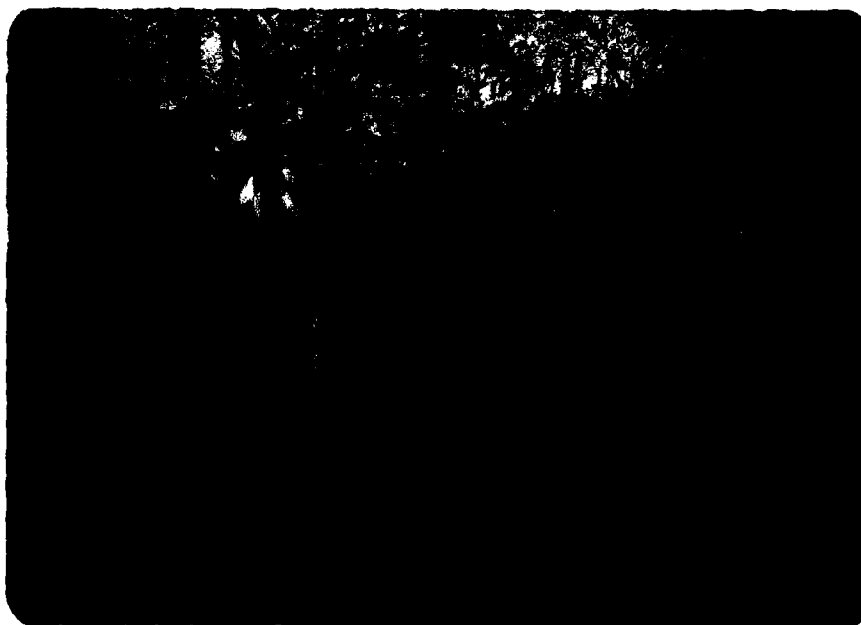


NO. 2 DOWNSTREAM SLOPE OF DAM

WEST POND OUTLET

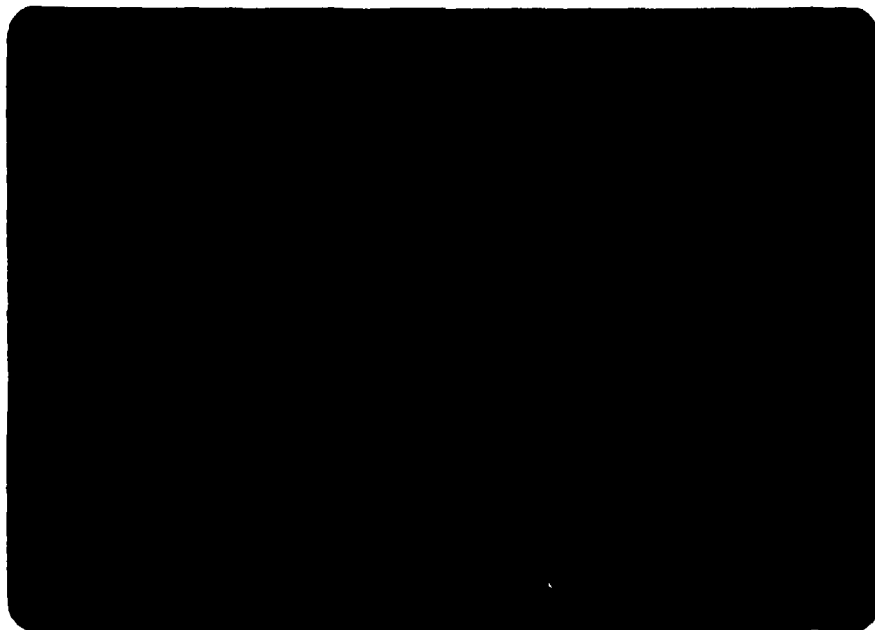


NO. 3 AREA OF OVERTOPPING ON TOP OF DAM

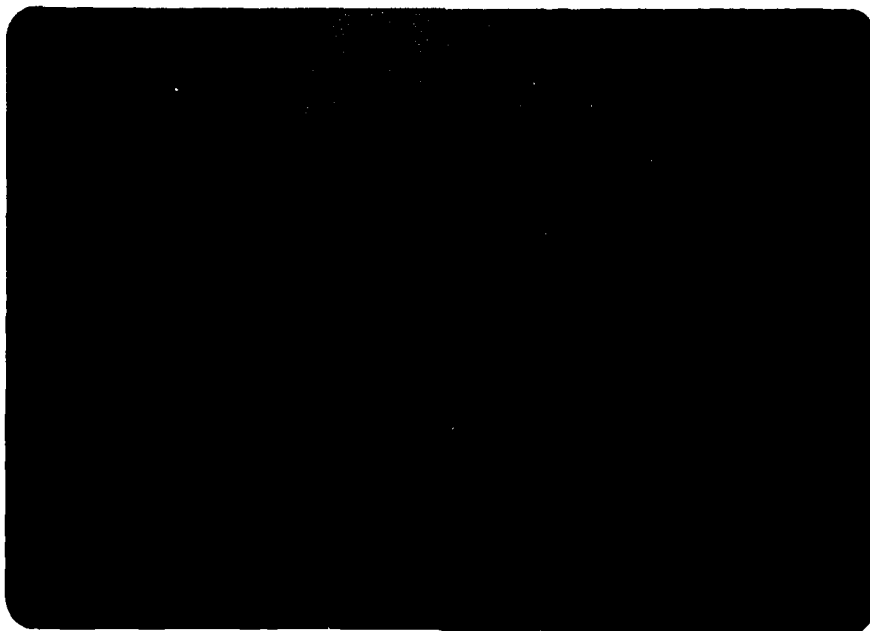


NO. 4 UPSTREAM VIEW OF SPILLWAY AND LOW SPOT ON TOP

WEST POND OUTLET



NO. 5 VIEW OF SPILLWAY



NO. 6 EAST ABUTMENT OF SPILLWAY

WEST POND OUTLET



NO. 7 WEST ABUTMENT AND TRAINING WALL OF SPILLWAY



NO. 8 DOWNSTREAM DISCHARGE CHANNEL

WEST POND OUTLET

APPENDIX D
HYDROLOGIC AND HYDRAULIC
CONDITIONS

WEST POND OUTLET

Project Nat. Review of Non Fed. Dams Acct. No. 6356 Page 1 of 5
 Subject Essex County, Mass. Comptd. By LEB Date 10/23/79
 Detail WEST POND Ch'd. By WC Date 11/19/79

Rev. 11/5/79

I Test Flood, Storage & Storage Functions

1- Total Drainage Area - 0.24 mi²

2- Pond(s) Area: 0
 Swamp(s) Area: .02
 Total Area Pond(s) & Swamp(s): .02

$$\% \text{Ponds \& Swamps} = \frac{.02}{0.24} = 8.3\%$$

$$3- \frac{175-73}{2700} = .0378 \quad \left. \vphantom{\frac{175-73}{2700}} \right\} \text{Say Ave Slope} = 3.7\%$$

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be just below "Rolling" and taken at 2200 c.f.s./mi²
 Size Class: Small ; Hazard Pot.: High ; Spill. Des. Flood: 100 yr to 1/2 PMF
 Use: Test Flood = 100 yr storm $\approx 1/4$ PMF

5- Test Flood Inflow = $\frac{1}{4}(2200) 0.24 = 132 \text{ cfs.}$

6- Pond Storage

The pond area is .012 sq. mi. at elev.
 Based on a const. area, storage increases at 7.6 ac. feet per foot of depth increase.

7- Spillway crest elev. is 72.6

8- Storage Functions are based on $Q_{out} = Q_{in} \left[1 - \frac{S_{out}}{R} \right]$

S_{out} = Storage Vol. in Reservoir related to final Q_{out} in terms of inches of rain over the drainage area.

$$S(\text{in Inches}) = 12 D \left(\frac{.012}{.24} \right) = 0.6 D, R = 6 \text{ hr rain of storm.}$$

D = Storage depth in feet above spillway crest in reservoir

9- Storage Functions: (Test Flood & 1/2 PMF - if needed)

$$F_{TF} = 132 - 27.8 S = 132 - 16.7 D$$

$$F_{1/2 PMF} = 264 - 27.8 S = 264 - 16.7 D$$

Project Nat. Review of Non Fed. Dams Acct. No. 6356 Page 2 of 5
 Subject Essex County, Mass. Comptd. By LEB Date 10/31/79
 Detail WEST POND Ch'd. By WC Date 11/12/79
 Rev. 11/5/79

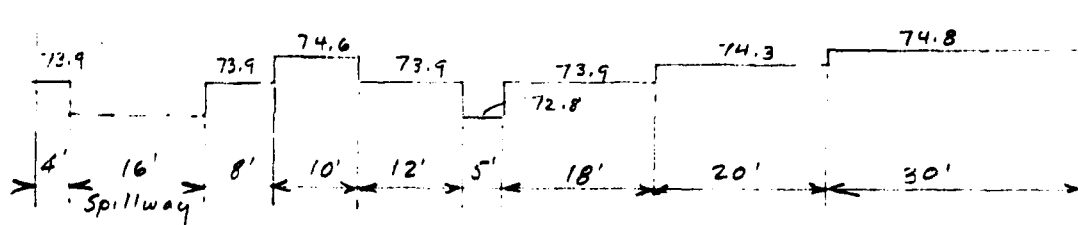
II Discharge Relations

A - Spillway

4' @ el. 72.6 & 12' @ el. 72.9 Let $g = 3.3 H_A^{1.5}$ - ignore end contr.

Pond El.	73	74	75	76	77	78	73.5	74.5
Q_1	3	22	49	83	122	166	11	35
Q_2	1	46	121	216	329	456	18	80
Q_A	4	68	170	299	451	622	29	115

B - Crest



Simplified Dam Crest

$g = 2.55 h^{1.5}$; 5' @ 72.8, 42' @ 73.9, 30' @ 74.3, 10' @ 74.6, 30' @ 74.8

Pond El.	73	74	75	73.5	74.5
Q_1	1	17	42	7	28
Q_2	—	3	123	—	50
Q_3	—	—	30	—	5
Q_4	—	—	6	—	—
Q_5	—	—	7	—	—
Q_B	1	20	208	7	83

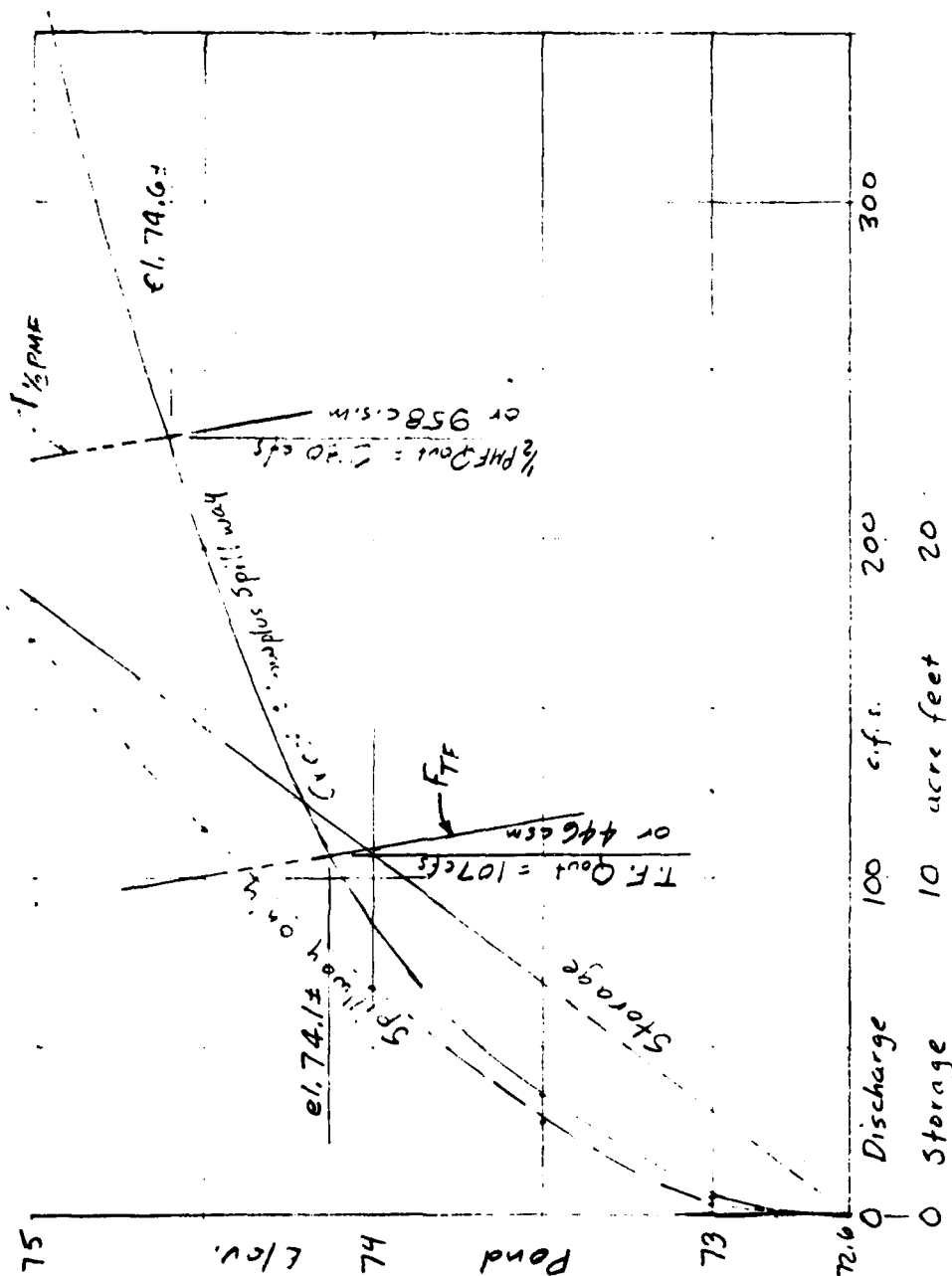
III Maximum Crest Flow

$g = 2.55 (74.1 - 72.8)^{1.5} = 3.8 \text{ cfs/ft}$ @ low point

As critical flow: $y_c = 0.76 \text{ ft}$, $V_c = 5.0 \text{ fps}$.

Project Nat. Review of Non Fed. Dams Acct. No. 6356 Page 3 of 5
 Subject Essex County, Mass Comptd. By LEB Date 10/31/79
 Detail WEST POND Ck'd. By WC Date 11/19/79
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IV Discharge, Storage & Storage Function vs Pond Elev.



METCALF & EDDY, ENGINEERS

Project Nat. Review of Non Fed. Dams Acct. No. 6356 Page 4 of 5
 Subject Essex County, Mass. Comptd. By LEB Date 10/31/79
 Detail WEST POND Ch'd. By WC Date 11/19/79

Ⓟ

Failure of Dam

Peak Failure Flow:

Pond Elevation - 72.8

Toe Elevation - 62.0

$Y_0 = 10.8$

Dam Length Subject to Breaching = 100'

$W_0 = 40\%(100) = 40'$

$$Q_R = 1.68 W_0 (Y_0)^{1.5} = 1.68(40)(10.8)^{1.5} = \underline{2385}$$

Ongoing discharge ≈ 0

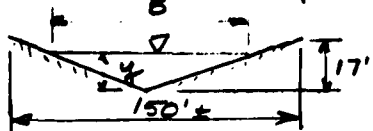
Storage Volume Released:

Storage Above Spillway $0.2(7.6) = 1.5 \text{ ac. ft}$

Storage Below Spillway $10.6(7.6)^{1/3} = \underline{26.8} \text{ " "}$

$S = \text{Total Storage} = \underline{28.3} \text{ " "}$

Channel Hydraulics: $S = \frac{2.9}{94} = .03085, \sqrt{S} = .17565$



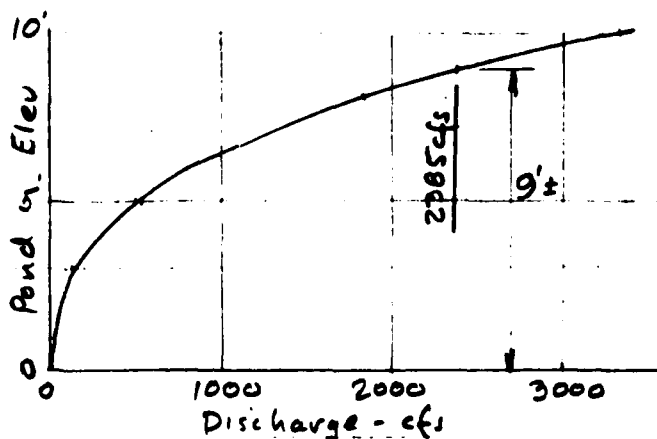
$$V = \frac{1.49}{0.10} \sqrt{S} R^{2/3} = 2.62 R^{2/3}; A = 4.412 y^2$$

$$P = 1.025 B = 9.044 y$$

y	A	$R^{2/3}$	V	Q
5	110.3	1.812	4.75	524
10	441.2	2.876	7.54	3324
8	282.4	2.479	6.49	1834
3	39.7	1.289	3.38	134

Failure wave $\pm 9'$ high
 7 normal flow @ $\pm 7 \text{ fps}$

Also see Ⓡ



Time to Drain:

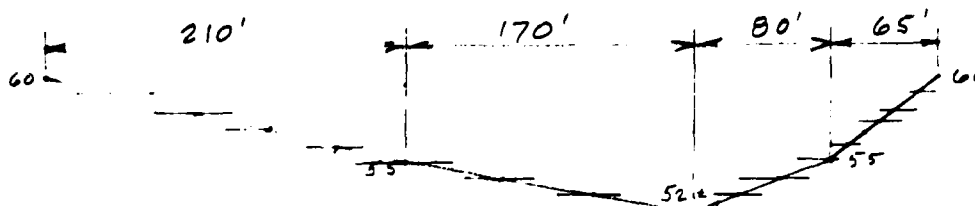
$$\frac{43560 (28.3)}{3600 (\frac{1}{2}) (2385)} = 0.29 \text{ Hours.}$$

Project Nat. Review of NonFed. Dams Acct. No. 0356 Page 5 of 5
 Subject Essex County, Mass. Comptd. By LEB Date 11/1/79
 Detail WEST POND Ckd. By WC Date 11/19/79

(VI) Downstream Section Discharge Relations

A - Hesperus Ave

Ignore value of culvert. Use $g = 2.55 h^{1.5}$ on ave length & intervals



41.6' @ 52; 83.4' @ 53; 83.4' @ 54; 69.1' @ 55; 55' @ 56; 55' @ 57; 55' @ 58

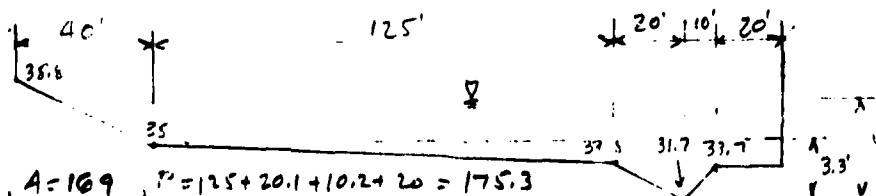
$$g = 2.55 h^{1.5}$$

Water Elev.	53	54	55	56	57
Q_1	106	300	531	849	1186
Q_2	—	213	602	1105	1701
Q_3	—	—	213	602	1105
Q_4	—	—	—	176	498
Q	106	513	1366	2732	4490

Max Depth @ L.P.
on road = $\pm 4.5'$
for failure flood

B - 450' ± South of Hesperus Ave

$$n = 1.08; S = \frac{10}{2500}; V = 3.842 R^{2/3}$$



For $y = 3.3$, $A = 169$, $P = 125 + 20.1 + 10.2 + 20 = 175.3$

y	A	$R^{2/3}$	V	Q	Water El.
3.3	169	.976	3.75	634	35
4.3	349	1.582	5.75	2041	36
5.3	540	1.963	7.54	4073	37

Max. Depth $\pm 5'$
for failure flood

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

WEST POND OUTLET

INVENTORY OF DAMS IN THE UNITED STATES

STATE	COUNTY	DISTRICT	CITY	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE (DAY MO YR)
MA	184	NED	MA 000 00	NEST POND OUTLET	4234.7	7042.5	07DEC79

POPULAR NAME	NAME OF IMPONDMENT	
	NEST POND	
RIVER OR STREAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	POPULATION
01 06 STREAM TO ATLANTIC OCEAN	GLOUCESTER	0 27900

TYPE OF DAM	YEAR COMPLETED	PURPOSES	HYDRAULIC POWER CAPACITY (KW)	IMPONDING CAPACITIES (ACRE-FT.)
REPS	1900	H	12 11	52 50

DIST OMN FED R PRV/REG 3CS A VER/DATE
NED N N N

REMARKS

D/S HAS CONTROL	SPILLWAY TYPE	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CU YD)	POWER CAPACITY (KW)	NAVIGATION LOCKS
2 123 U	4	1	160		

OWNER	ENGINEERING BY	CONSTRUCTION BY
RICHARD RUSSO	UNKNOWN	UNKNOWN

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE (DAY MO YR)	AUTHORITY FOR INSPECTION
METCALF AND EDDY INC	27SE-79	PL92-367

REMARKS